DEFENSE INFORMATION SYSTEMS AGENCY
P. O. BOX 4502
ARLINGTON, VIRGINIA 22204-4502

IN REPLY
REFER TO: Joint Interoperability Test Command (JTE) 23 July 2008

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of NET VX900 with Software Release 4.3.5 Version 55

References: (a) DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) CJCSI 6212.01D, "Interoperability and Supportability of Information Technology and National Security Systems," 8 March 2006
(c) through (e), see enclosure 1

1. References (a) and (b) establish the Defense Information Systems Agency (DISA), Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification.

2. The NET VX900 with Software Release 4.3.5 Version 55 is hereinafter referred to as the System Under Test (SUT). The SUT met all of the interface and functional requirements and is certified for joint use within the DSN as a Tactical Network Element (T-NE) and Strategic Network Element (S-NE) as set forth in appendices 2 and 9 of reference (c) using test procedures derived from reference (d). No other configurations, features, or functions, except those cited within this report, are certified by the JITC, or authorized by the Program Management Office for use within the DSN. This certification expires upon changes that affect interoperability, but no later than three years from the date of this memorandum.

3. This certification is based on interoperability testing of the SUT and review of the vendor's Letters of Compliance (LoC). Interoperability testing was conducted by JITC at the Global Information Grid Network Test Facility, Fort Huachuca, Arizona, from 7 through 25 January 2008 and 28 April through 23 May 2008. The Theatre Joint Tactical Network (TJNT) Group adjudicated the noted discrepancies on 11 June 2008 and is documented in reference (e).

4. The SUT Interoperability Test Summary is shown in table 1 and the Capability and Feature Requirements used to evaluate the interoperability of the SUT are indicated in table 2.

Table 1. SUT Interoperability Test Summary

DSN Access Interfaces			
Interface & Signaling	**Critical**	**Status**	**Remarks**
T1 ISDN PRI NI2 (ANSI T1.619a)	No[1]	Certified	Met all CRs and FRs with the following minor exception: The SUT does not support NFAS signaling.[2]
DSN Transport Interfaces			
Transport Level	**Critical**	**Status**	**Remarks**
100 Mbps Ethernet	No[3]	Certified	Met all CRs and FRs.
Features and Capabilities			
Features and Capabilities	**Critical**	**Status**	**Remarks**
Synchronization	Yes	Certified	Met all CRs and FRs.
Network Management	Yes	Certified	Met all CRs and FRs.
Security	Yes	See note 4.	See note 4.

LEGEND:

ANSI	- American National Standards Institute	NFAS	- Non Facility Associated Signaling
CRs	- Capability Requirements	NI2	- National ISDN 2
DISA	- Defense Information Systems Agency	PRI	- Primary Rate Interface
DSN	- Defense Switched Network	SS7	- Signaling System 7
FRs	- Feature Requirements	SUT	- System Under Test
ISDN	- Integrated Services Digital Network	T1	- Digital Transmission Link Level 1 (1.544 Mbps)
Mbps	- Megabits per second	T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
MLPP	- Multi-Level Precedence and Preemption	UCR	- Unified Capabilities Requirements

NOTES:

1 The UCR does not stipulate a minimum Access interface requirement for a Tactical or Strategic Network Element.

2 The SUT does not support T1 PRI NFAS configurations. A discrepancy was found that occurred when both members of an active call went on-hook simultaneously. When the SUT receives DISCONNECT messages for the same call from both directions at approximately the same time, it does not propagate the messages through the nodes. This prevents the DSN switches from completing the ISDN message transaction. The resulting condition is a longer guard interval time at the DSN switch for that channel while the switch times out. Until the time out occurs the respective channel remains in a busy state at both switches and cannot be accessed by subsequent callers. The switch still processes calls to other idle trunks. The Theatre Joint Tactical (TJTN) Group adjudicated this discrepancy with the conclusion that it will have a minor operational impact. The T1 interface supports both Alternate Mark Inversion (AMI) and Bipolar Eight Zero Substitution (B8ZS) line coding with Extended Super-Frame (ESF), Super-Frame (SF).

3 The UCR does not stipulate a minimum Transport interface requirement a Tactical or Strategic Network Element.

4 Security testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.

Table 2. SUT Capability and Feature Interoperability Requirements

DSN Access Interfaces			
DSN Switch Access Interfaces	**Critical**	**Requirements Required or Conditional**	**References**
T1 ISDN PRI NI2 (ANSI T1.619a)	No[1]	• DS1 Supervisory Channel Associated Signaling (R) • DS1 Clear Channel Capability (R) • DS1 Alarm and Restoral Requirements (R) • MLPP (R) • MOS (R) • BERT (R) • Secure Transmission (Voice and Data) (R) • Modem (R) • Facsimile (R) • Call Control Signals (R) • Carrier Group Alarms (R) • Call Congestion (R) • Voice Compression (C)	• UCR App. A9.5.1.2.4 • UCR App. A9.5.1.2.4 • UCR App. A9.5.1.2.4 • UCR App. A9.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1.1 • UCR App. A9.5.1.1.2 • UCR App. A9.5.1.1.4

Table 2. SUT Capability and Feature Interoperability Requirements (continued)

DSN Transport Interface			
Interface	**Critical**	**Requirements Required or Conditional**	**References**
Fast Ethernet 100BaseT	Yes	• MOS (R): T-NE Only • BERT (R): T-NE Only • Modem (R): T-NE Only • Testing in Simulated Tactical Environment (R) T-NE only • Call Congestion Control - At least one of the following four methods shall be used: - Differential Services (C) o CoS: IEEE 802.1p priority bit or Differential Services Code Point o QoS: NE that supports converged services shall have a minimum of four Queues o Signaling (Network Control, user signaling) (Highest) o Inelastic RTS (Command & Telemetry, Circuit Emulation, Voice, Interactive VTC Video, Streaming Video) o Preferred Elastic (Interactive Transaction, File Transfer) o Elastic (Default, Scavenger) - Integrated Services – Bandwidth reservation for IP traffic (C) - Congestion is not possible (C) - Software Capability to limit provisioning of input and output interfaces such that congestion is not possible under worst conditions (C) • Delay: Not to exceed 5 ms average over 5 min period • Jitter: Not to exceed 5 ms average over 5 min period • Packet Loss: Not to exceed .05% average over 5 min period	• UCR para. A2.4.1 • UCR para. A2.4.1 • UCR para. A2.4.1 • UCR para. A2.4 • UCR App. A9.5.1.1.2.2b • UCR App A9.5.1.2.9 • UCR App A9.5.1.2.9 • UCR App A9.5.1.2.9
SUT Features And Capabilities			
Feature/Capability	**Critical**	**Requirements Required or Conditional**	**References**
Synchronization	Yes	• Timing (R)	• UCR para. A9.5.1.2.7
Network Management	Yes	• Management Option (R) - Local Management (Front Panel and/or External Console) (C) - ADIMSS (C) • Fault Management (C) • Loop Back Capability (C) • Operational Configuration Restoral (R)	• UCR para. A9.5.2.1 • UCR para. A9.5.2.2 • UCR para. A9.5.2.3 • UCR para. A9.5.3
Security	Yes	• DIACAP (R)	• UCR para. A9.6

LEGEND:

100BaseT	- 100 Mbps (Baseband Operation, Twisted Pair) Ethernet	MOS	- Mean Opinion Score
802.1p	- LAN Layer 2 QoS/CoS Protocol for Traffic Prioritization	ms	- millisecond
A	- Appendix	NE	- Network Element
ADIMSS	- Advanced DSN Integrated Management Support System	NI2	- National ISDN 2
ANSI	- American National Standards Institute	para	- paragraph
BERT	- Bit Error Rate Test	PRI	- Primary Rate Interface
C	- Conditional	QoS	- Quality of Service
CoS	- Class of Service	R	- Required
DIACAP	- Department of Defense Information Assurance Certification and Accreditation Process	RTS	- Real Time Services
		S-NE	- Strategic Network Element
DS1	- Digital Signal Level 1	SS7	- Signaling System 7
DSN	- Defense Switched Network	SUT	- System Under Test
DSS1	- Digital Subscriber Signaling 1	T1	- Digital Transmission Link Level 1 (1.544 Mbps)
IEEE	- Institute of Electrical and Electronics Engineers	T1.607	- ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer Service for DSS1
IP	- Internet Protocol		
ISDN	- Integrated Services Digital Network	T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
LAN	- Local Area Network	T-NE	- Tactical Network Element
Mbps	- Megabits per second	UCR	- Unified Capabilities Requirements
min	- minute	VTC	- Video Teleconferencing
MLPP	- Multi-Level Precedence and Preemption		

NOTES:
1 The UCR does not stipulate a minimum Access interface requirement for a Tactical or Strategic Network Element.
2 The UCR does not stipulate a minimum Transport interface requirement for a Tactical or Strategic Network Element.

5. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/.gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at http://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi.

6. The JITC point of contact is Mr. Michael Napier, DSN 879-6787, commercial (520) 538-6787, FAX DSN 879-4347, or e-mail to Michael.Napier@disa.mil. The JITC's mailing address is P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The tracking number for the SUT is 086003.

FOR THE COMMANDER:

2 Enclosures a/s

RICHARD A. MEADOR
Chief
Battlespace Communications Portfolio

JITC Memo, JTE, Special Interoperability Test Certification of the NET VX900 with Software Release 4.3.5 Version 55

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Defense Information Systems Agency (DISA), ATTN: GS23 (Mr. McLaughlin), Room 5W23, 5275 Leesburg Pike (RTE 7), Falls Church, VA 22041

ADDITIONAL REFERENCES

(c) Defense Information Systems Agency, "Department of Defense Networks, Unified Capabilities Requirements," 21 December 2007
(d) Joint Interoperability Test Command, "Defense Switched Network Generic Switch Test Plan (GSTP), Change 2," 2 October 2007
(e) E-mail from Mr. John Caruso, "VX900 High-Speed Modem Question," 10 June 2008

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. NET VX900 with Software Release 4.3.5 Version 55; hereinafter referred to as the System Under Test (SUT).

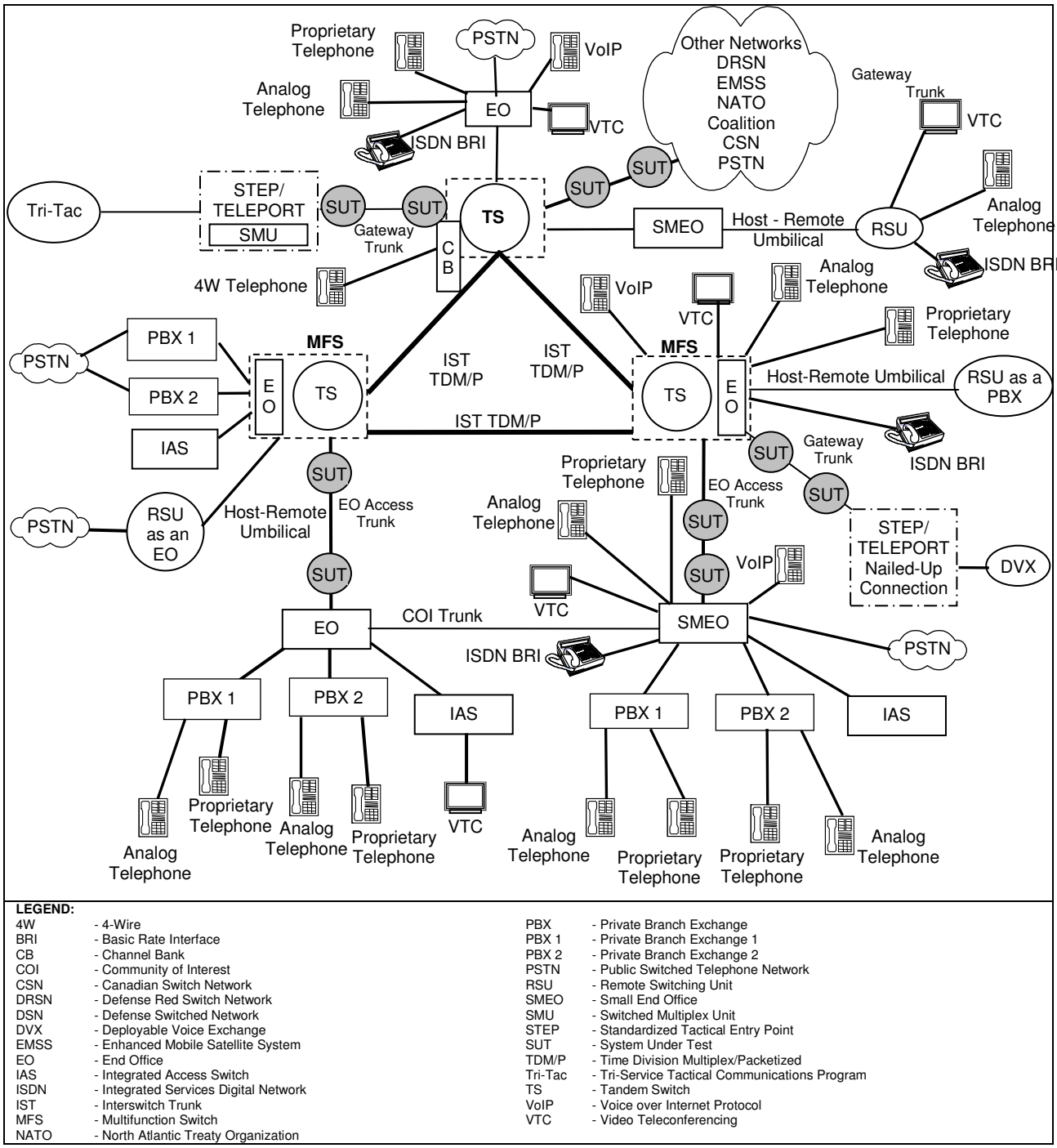
2. PROPONENT. Defense Information Systems Agency (DISA).

3. PROGRAM MANAGER. Mr. John Wilson, DISA, 7 Skyline Place, 5275 Leesburg Pike, Falls Church, Virginia, 22041, email: john.wilson@disa.mil.

4. TESTER. Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.

5. SYSTEM UNDER TEST DESCRIPTION. The SUT can be used in the DSN as a Tactical Network Element (T-NE) and Strategic Network Element (S-NE). The NET VX900 platform is used to transport Time Division Multiplexing (TDM) access trunks via Internet Protocol (IP) transport. The SUT has a Digital Transmission Link Level 1 (T1) Integrated Services Digital Network (ISDN) Primary Rate Interface (PRI) access interface and a 100 Megabits per second (Mbps) transport interface. The VX900 provides call compression and frame packing that reduces the total IP overhead in transporting TDM voice trunks from a tactical to fixed location. The VX900 utilizes an embedded XP platform that is managed by the Shout Packet Module (SPM). The SPM is located between the Ethernet driver and the OS preventing any undesirable network traffic from entering the system. The SUT offers two modes of operation: the Lease Line Emulation Mode (LLEM) and the Cluster Mode. The vendor acknowledges that the cluster mode does not fully support the requirement for Multi-Level Precedence and Preemption (MLPP), and it was therefore not tested. Only the LLEM Mode was tested and is covered under this certification.

6. OPERATIONAL ARCHITECTURE. The Unified Capabilities Requirements (UCR) DSN architecture in figure 2-1 depicts the relationship of the SUT to the DSN switches.



LEGEND:

4W	- 4-Wire
BRI	- Basic Rate Interface
CB	- Channel Bank
COI	- Community of Interest
CSN	- Canadian Switch Network
DRSN	- Defense Red Switch Network
DSN	- Defense Switched Network
DVX	- Deployable Voice Exchange
EMSS	- Enhanced Mobile Satellite System
EO	- End Office
IAS	- Integrated Access Switch
ISDN	- Integrated Services Digital Network
IST	- Interswitch Trunk
MFS	- Multifunction Switch
NATO	- North Atlantic Treaty Organization
PBX	- Private Branch Exchange
PBX 1	- Private Branch Exchange 1
PBX 2	- Private Branch Exchange 2
PSTN	- Public Switched Telephone Network
RSU	- Remote Switching Unit
SMEO	- Small End Office
SMU	- Switched Multiplex Unit
STEP	- Standardized Tactical Entry Point
SUT	- System Under Test
TDM/P	- Time Division Multiplex/Packetized
Tri-Tac	- Tri-Service Tactical Communications Program
TS	- Tandem Switch
VoIP	- Voice over Internet Protocol
VTC	- Video Teleconferencing

Figure 2-1. DSN Architecture

7. REQUIRED SYSTEM INTERFACES. The SUT Interoperability Test Summary is shown in table 2-1 and the Capability and Feature Requirements used to evaluate the interoperability of the SUT are indicated in table 2-2.

Table 2-1. SUT Interoperability Test Summary

DSN Access Interfaces			
Interface & Signaling	**Critical**	**Status**	**Remarks**
T1 ISDN PRI NI2 (ANSI T1.619a)	No[1]	Certified	Met all CRs and FRs with the following minor exception: The SUT does not support NFAS signaling.[2]
DSN Transport Interfaces			
Transport Level	**Critical**	**Status**	**Remarks**
100 Mbps Ethernet	No[3]	Certified	Met all CRs and FRs.
Features and Capabilities			
Features and Capabilities	**Critical**	**Status**	**Remarks**
Synchronization	Yes	Certified	Met all CRs and FRs.
Network Management	Yes	Certified	Met all CRs and FRs.
Security	Yes	See note 4.	See note 4.

LEGEND:

ANSI	- American National Standards Institute	NFAS	- Non Facility Associated Signaling
CRs	- Capability Requirements	NI2	- National ISDN 2
DISA	- Defense Information Systems Agency	PRI	- Primary Rate Interface
DSN	- Defense Switched Network	SS7	- Signaling System 7
FRs	- Feature Requirements	SUT	- System Under Test
ISDN	- Integrated Services Digital Network	T1	- Digital Transmission Link Level 1 (1.544 Mbps)
Mbps	- Megabits per second	T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
MLPP	- Multi-Level Precedence and Preemption	UCR	- Unified Capabilities Requirements

NOTES:

1 The UCR does not stipulate a minimum Access interface requirement for a Tactical or Strategic Network Element.

2 The SUT does not support T1 PRI NFAS configurations. A discrepancy was found that occurred when both members of an active call went on-hook simultaneously. When the SUT receives DISCONNECT messages for the same call from both directions at approximately the same time, it does not propagate the messages through the nodes. This prevents the DSN switches from completing the ISDN message transaction. The resulting condition is a longer guard interval time at the DSN switch for that channel while the switch times out. Until the time out occurs the respective channel remains in a busy state at both switches and cannot be accessed by subsequent callers. The switch still processes calls to other idle trunks. The Theatre Joint Tactical (TJTN) Group adjudicated this discrepancy with the conclusion that it will have a minor operational impact. The T1 interface supports both Alternate Mark Inversion (AMI) and Bipolar Eight Zero Substitution (B8ZS) line coding with Extended Super-Frame (ESF), Super-Frame (SF).

3 The UCR does not stipulate a minimum Transport interface requirement a Tactical or Strategic Network Element.

4 Security testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.

Table 2-2. SUT Capability and Feature Interoperability Requirements

DSN Access Interfaces			
DSN Switch Access Interfaces	**Critical**	**Requirements Required or Conditional**	**References**
T1 ISDN PRI NI2 (ANSI T1.619a)	No[1]	• DS1 Supervisory Channel Associated Signaling (R) • DS1 Clear Channel Capability (R) • DS1 Alarm and Restoral Requirements (R) • MLPP (R) • MOS (R) • BERT (R) • Secure Transmission (Voice and Data) (R) • Modem (R) • Facsimile (R) • Call Control Signals (R) • Carrier Group Alarms (R) • Call Congestion (R) • Voice Compression (C)	• UCR App. A9.5.1.2.4 • UCR App. A9.5.1.2.4 • UCR App. A9.5.1.2.4 • UCR App. A9.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1 • UCR App. A9.5.1.1.1 • UCR App. A9.5.1.1.2 • UCR App. A9.5.1.1.4

Table 2. SUT Capability and Feature Interoperability Requirements (continued)

DSN Transport Interface			
Interface	**Critical**	**Requirements Required or Conditional**	**References**
Fast Ethernet 100BaseT	Yes	• MOS (R): T-NE Only • BERT (R): T-NE Only • Modem (R): T-NE Only • Testing in Simulated Tactical Environment (R) T-NE only • Call Congestion Control - At least one of the following four methods shall be used: - Differential Services (C) o CoS: IEEE 802.1p priority bit or Differential Services Code Point o QoS: NE that supports converged services shall have a minimum of four Queues o Signaling (Network Control, user signaling) (Highest) o Inelastic RTS (Command & Telemetry, Circuit Emulation, Voice, Interactive VTC Video, Streaming Video) o Preferred Elastic (Interactive Transaction, File Transfer) o Elastic (Default, Scavenger) - Integrated Services – Bandwidth reservation for IP traffic (C) - Congestion is not possible (C) - Software Capability to limit provisioning of input and output interfaces such that congestion is not possible under worst conditions (C) • Delay: Not to exceed 5 ms average over 5 min period • Jitter: Not to exceed 5 ms average over 5 min period • Packet Loss: Not to exceed .05% average over 5 min period	• UCR para. A2.4.1 • UCR para. A2.4.1 • UCR para. A2.4.1 • UCR para. A2.4 • UCR App. A9.5.1.1.2.2b • UCR App A9.5.1.2.9 • UCR App A9.5.1.2.9 • UCR App A9.5.1.2.9
SUT Features And Capabilities			
Feature/Capability	**Critical**	**Requirements Required or Conditional**	**References**
Synchronization	Yes	• Timing (R)	• UCR para. A9.5.1.2.7
Network Management	Yes	• Management Option (R) - Local Management (Front Panel and/or External Console) (C) - ADIMSS (C) • Fault Management (C) • Loop Back Capability (C) • Operational Configuration Restoral (R)	• UCR para. A9.5.2.1 • UCR para. A9.5.2.2 • UCR para. A9.5.2.3 • UCR para. A9.5.3
Security	Yes	• DIACAP (R)	• UCR para. A9.6

LEGEND:

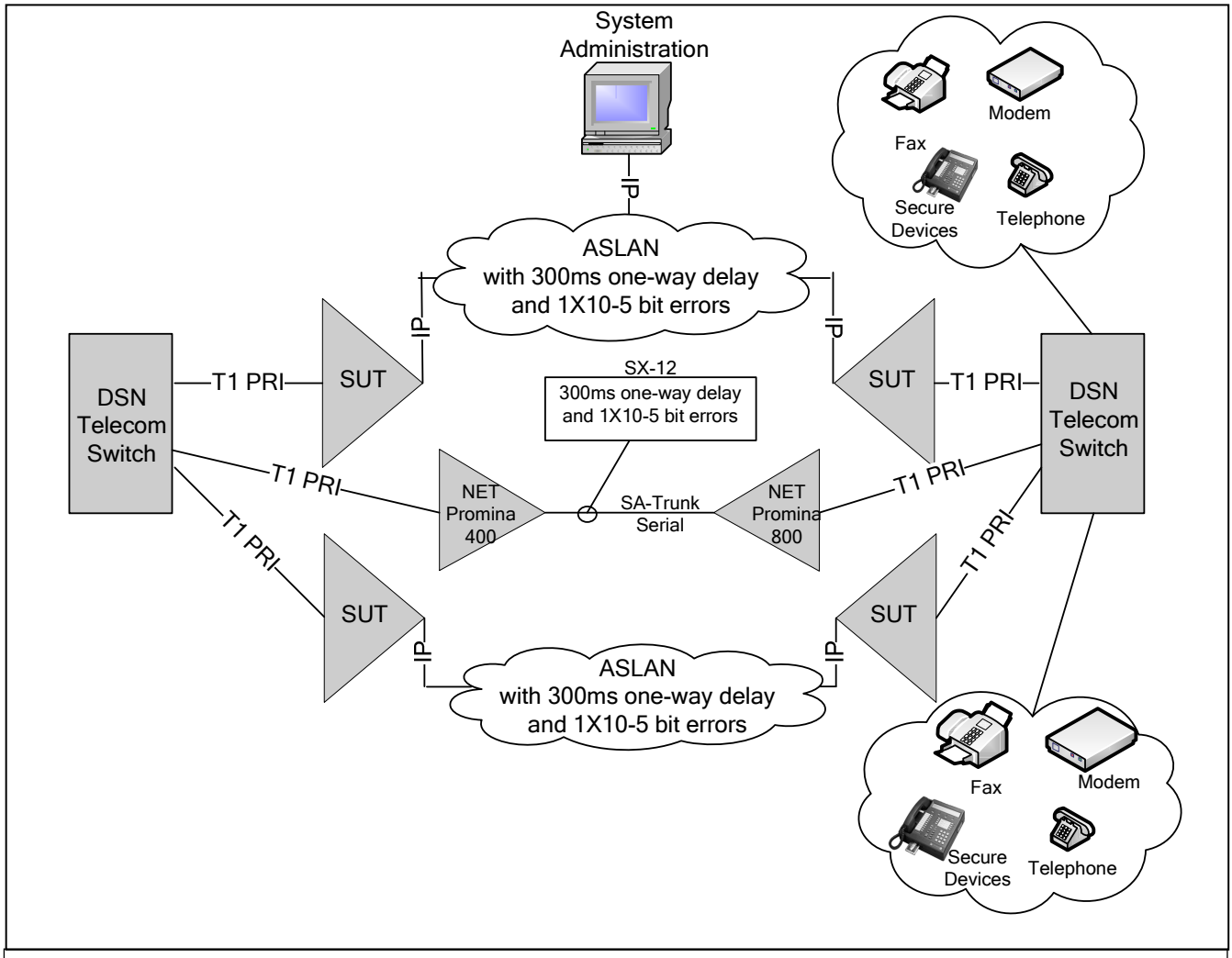
100BaseT	- 100 Mbps (Baseband Operation, Twisted Pair) Ethernet
802.1p	- LAN Layer 2 QoS/CoS Protocol for Traffic Prioritization
A	- Appendix
ADIMSS	- Advanced DSN Integrated Management Support System
ANSI	- American National Standards Institute
BERT	- Bit Error Rate Test
C	- Conditional
CoS	- Class of Service
DIACAP	- Department of Defense Information Assurance Certification and Accreditation Process
DS1	- Digital Signal Level 1
DSN	- Defense Switched Network
DSS1	- Digital Subscriber Signaling 1
IEEE	- Institute of Electrical and Electronics Engineers
IP	- Internet Protocol
ISDN	- Integrated Services Digital Network
LAN	- Local Area Network
Mbps	- Megabits per second
min	- minute
MLPP	- Multi-Level Precedence and Preemption
MOS	- Mean Opinion Score
ms	- millisecond
NE	- Network Element
NI2	- National ISDN 2
para	- paragraph
PRI	- Primary Rate Interface
QoS	- Quality of Service
R	- Required
RTS	- Real Time Services
S-NE	- Strategic Network Element
SS7	- Signaling System 7
SUT	- System Under Test
T1	- Digital Transmission Link Level 1 (1.544 Mbps)
T1.607	- ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer Service for DSS1
T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
T-NE	- Tactical Network Element
UCR	- Unified Capabilities Requirements
VTC	- Video Teleconferencing

NOTES:

1 The UCR does not stipulate a minimum Access interface requirement for a Tactical or Strategic Network Element.

2 The UCR does not stipulate a minimum Transport interface requirement for a Tactical or Strategic Network Element.

8. TEST NETWORK DESCRIPTION. The SUT was tested at JITC's Global Information Grid Network Test Facility (GNTF) in a manner and configuration similar to that of its DSN operational environment. Testing the system's required functions and features was conducted using the test configurations depicted in figures 2-2 and 2-3.



LEGEND:

ASLAN	- Assured Services Local Area Network	PRI	- Primary Rate Interface
DSN	- Defense Switched Network	SA	- Symmetrical/Asymmetrical
IP	- Internet Protocol	SUT	- System Under Test
Mbps	- Megabits per second	Telecom	- Telecommunications
ms	- milliseconds	T1	- Digital Transmission Link Level 1 (1.544 Mbps)

Figure 2-2. Test Configuration with Multiple Pathways

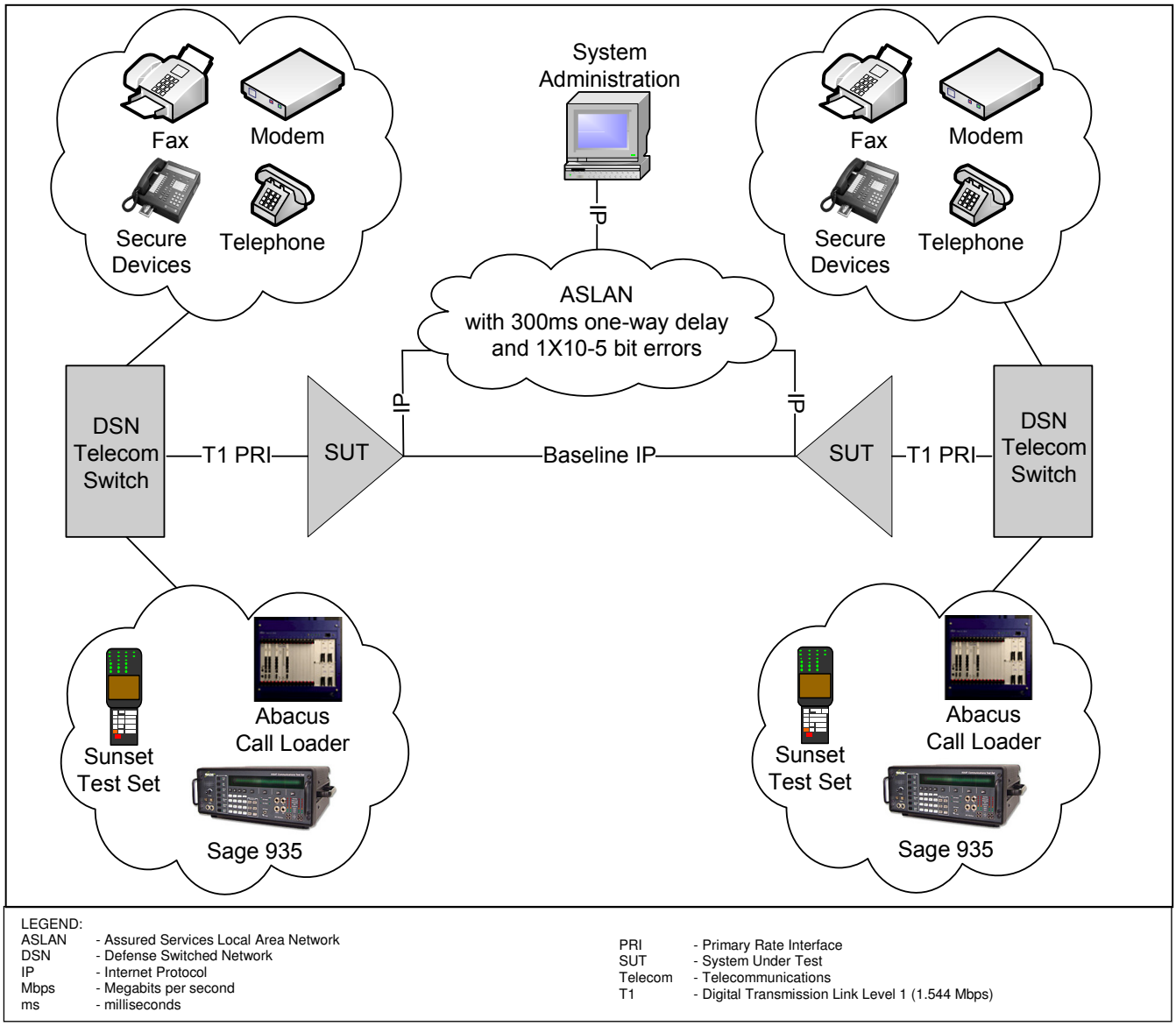


Figure 2-3. Test Configuration with a Single Pathway

9. SYSTEM CONFIGURATIONS. Table 2-3 provides the system configurations used in the test. The SUT was tested in an operationally realistic environment to determine interoperability with a complement of DSN switches noted in table 2-3. The DSN switches listed in table 2-3 only depict the tested configuration. Table 2-3 is not intended to identify the only switches that are certified with the SUT. The SUT is certified with switching systems listed on the DSN Approved Products List (APL) that offer the same certified SUT interfaces.

Table 2-3. Tested System Configurations

System Name		Hardware/Software Release
Nortel CS1000M SG		4.5W
NET Promina 400		Software Release 4.x.2.02 Version 92.45
NET Promina 800		Software Release 4.x.2.02 Version 92.45
Nortel CS2100		Succession Enterprise (SE)09
Siemens EWSD		19d with Patch Set 46
Alcatel-Lucent 5ESS		5E16.2 Broadcast Warning Message (BWM) 07-0003
Avaya S8710		Communication Manager (CM) 4.0 (R014x.00.2.731.7: Super Patch 14419)
Redcom HDX		3.0A R3P0
SUT	VX900 with Software Release 4.3.5 Version 55	Chassis Type: VX900AD
		Card Type: STIX-4T1E1/DSP
	System Administration Computer	Microsoft Windows XP Pro 2002, Service Pack 2

LEGEND:
5ESS - Class 5 Electronic Switching System
CS - Communication Server
DSP - Digital Signaling Processor
EWSD - Elektronisches Wählsystem Digital
HDX - High Density Exchange
SG - Single Group
SUT - System Under Test

10. TEST LIMITATIONS. None.

11. TEST RESULTS

a. Discussion

(1) DSN Interfaces. The SUT supports a T1 ISDN PRI access interface and a 100 Mbps Ethernet transport interface. The access interface was mapped through the test network over the transport interface. The specific requirements and test results of the DSN interface testing are described below.

(a) Access Interface Characteristics. The SUT interface access characteristics were tested according to UCR, appendix 9, paragraph A9.5.1.2.4. The SUT does not support T1 PRI Non Facility Associated Signaling (NFAS) configurations. A discrepancy was found that occurred when both members of an active call went on-hook simultaneously. When the SUT receives DISCONNECT messages for the same call from both directions at approximately the same time, it does not propagate the messages through the nodes. This prevents the DSN switches from completing the ISDN message transaction. The resulting condition is a longer guard interval time at the DSN switch for that channel while the switch times out. Until the time out occurs the respective channel remains in a busy state at both switches and cannot be accessed by subsequent callers. The switch still processes calls to other idle trunks. The Theatre

Joint Tactical (TJTN) Group adjudicated this discrepancy with the conclusion that it will have a minor operational impact. The T1 interface supports both Alternate Mark Inversion (AMI) and Bipolar Eight Zero Substitution (B8ZS) line coding with Extended Super-Frame (ESF), Super-Frame (SF). All access interface characteristics were verified through vendor Letter of Compliance (LoC) and testing.

(b) DSN Transport Interfaces. The SUT only supports IP transport interfaces. The IP interface provides 100 Mbps of transport bandwidth.

(c) The SUT was tested in accordance with UCR appendix 2, paragraph A2.1.1, which states that the T-NEs shall be tested under a simulated tactical environment using the Operational Area Network (OAN) architecture framework, the inclusion of satellite transmission for inter-nodal links and a random bit error rate (BER) of $1x10^{-5}$.

(d) Clear Channel Capability. The SUT is capable of transmitting and receiving B8ZS line coding as required in the UCR, appendix 9, paragraph A9.5.1.2.4 for Clear Channel Capability.

(e) Alarm and Restoral Requirements. The UCR appendix 9, paragraph A9.5.1.1.1, states that the NE shall be able to propagate Carrier Group Alarms (CGAs) in accordance with UCR, section 7, upon physical loss of the TDM interface. Voice switching systems shall receive the proper CGAs from the NE upon loss of the transport link between NEs, regardless of whether it is TDM or Internet Protocol (IP). The SUT is capable of transparently passing the alarm and restoral features of the DSN switch's digital interface unit, which meets the requirement.

(f) Latency. The UCR appendix 9, paragraph A9.5.1, states that the addition of a NE (non-compressed clear channel links) shall not increase the one-way delay measured from ingress to egress (per node) more than 5 milliseconds (ms). In addition, paragraph A9.5.1.2.9, states that the addition of a NE shall not increase the one-way packet delay for each NE used with compression codecs as follows: TDM Ingress to Transcoding Packet Egress shall not increase delay by more than 100 ms as measured from end-to-end as a pair. The UCR, appendix 2, paragraph A2.4.1, states the addition of T-NE with International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) G.723.1 transcoding shall not cause the one-way packet delay measured from ingress to egress to increase by more than 180 ms per node pair. The average one-way delay for each of the sampled five-minute periods, measured between NE devices, was: 50.4 ms for ITU-T G.711, 69.4 ms for ITU-T G.729, 62.8 ms for ITU-T G.723.1 (5.3k), and 64.1 ms for ITU-T G.723.1 (6.3k). This meets the specified requirements.

(g) Jitter. Jitter occurs when packets are sent and received with timing variations. The UCR, appendix 9, paragraph A9.5.1.2.9b, states the addition of S-NE shall not cause jitter measured from ingress to egress to increase by more than five ms

or less averaged over any five-minute period. With a full bandwidth load, jitter was measured to be 0.0 ms over a five-minute period, which met the requirement.

(h) Packet Loss. Packet loss occurs when packets are sent, but not received at the final destination. The UCR, appendix 9, paragraph A9.5.1.2.9c, states that the addition of an S-NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05 percent averaged over any five-minute period. With a full bandwidth load, the measured packet loss was 0.00 percent over a five-minute period.

(i) Mean Opinion Score (MOS). The Abacus call loader and Sage 935 communications test sets were used for conducting MOS tests.

1. The UCR appendix 9, paragraph A9.5.1.1, states that the introduction of S-NEs shall not cause the end-to-end average MOS to fall below 4.0 as measured over any 5-minute time interval. There were 35,892 calls placed through the test network using the ITU-T G.711 codec with no impairment all having an MOS of 4.0 or greater, which meets the requirement.

2. The UCR, appendix A2.4.1, states the introduction of T-NEs shall not cause the end-to-end average MOS to fall below 3.6 as measured over any 5-minute time interval in accordance with. There were 35,892 calls placed through the test network, over all supported codecs with impairment all having an MOS of 3.6 or greater, which meets the requirement.

(j) Bit Error Rate Tests (BERTs)

1. The S-NE requirements in the UCR, appendix 9, paragraph A9.5.1.1, state that the introduction of an S-NE shall not cause the end-to-end digital bit error rate to exceed the requirement of less than 1 error in $1x10^9$ (averaged over a nine-hour period). The S-NE met the requirement with a recorded bit error ratio of 0.00 percent.

2. The T-NE requirements in the UCR appendix 2, paragraph A2.4.1, states the introduction of a T-NE shall not cause the end-to-end digital bit error rate to degrade by more than 0.03 percent over an 8-hour period. The SUT with no impairments met the requirement with a recorded bit error ratio of 0.00 percent.

(k) Secure Transmission (Voice and Data). UCR appendix 9, paragraph A9.5.1.1, states that the introduction of NEs shall not degrade secure transmission for secure end devices as defined by Appendix 10. Secure modem relay must be configured in the SUT for each access interface for proper functionality of secure devices. There were 290 secure calls placed over the test configurations shown in figures 2-2 and 2-3 between Secure Terminal Equipment and Secure Wireline Terminals without degrading transmissions between end devices, which meet the requirement. These tests included secure voice, data, fax, and crypto rekey.

(l) Modem. For proper functionality of standard modem calls, a route must be created through the SUT for ITU-T G.711 clear channel that is independent of the secure device modem relay. Standard modem calls will not work when the secure device modem relay is activated. To simultaneously support secure devices and standard modems, the SUT must be configured to route modem calls over the ITU-T G.711 codec based upon the number dialed for the modem connection.

1. The S-NE requirements in UCR appendix 9, paragraph A9.5.1.1, state that the NEs shall support a minimum modem transmission speed of 9.6 kbps. The Abacus call loader was used to place 20,010 modem calls through the S-NE configuration and all modem calls had a transmission rate of equal to or greater than 9.6 kbps, which meets the requirements.

2. The T-NE requirements in the UCR appendix 2, paragraph A2.4.1, state that the T-NE shall allow a minimum modem transmission speed of 2.4 kbps across the associated network elements. There were 20,010 modem calls placed through the SUT using the Abacus call loader using this configuration with a transmission rate equal to or greater that 2.4 kbps of which meets the requirement.

(m) Facsimile. UCR appendix 9, paragraph A9.5.1.1 and appendix 2, paragraph A2.4.1, state that NEs shall support a minimum facsimile transmission speed of 9.6 kbps across the associated NEs. There were 55,890 successful facsimile calls placed through the SUT using the Abacus call loader at a minimum transmission speed of 9.6 kbps, which meets the requirement.

(n) Call Control Signals. UCR appendix 9, paragraph A9.5.1.1, states that the NE shall transport all call control signals transparently on an end-to-end basis. The SUT transparently transported all Multi-Level Precedence and Preemption (MLPP) call control signals, which meets the requirement.

(o) Call Congestion. UCR appendix 9, paragraph A9.5.1.1.3, states that the call congestion handling can be met one of the following three ways: dynamic load control signal; software capability which makes congestion impossible; or congestion is not possible in the SUT. Call congestion is not possible in the SUT, which meets the requirement.

(p) Voice Compression. UCR appendix 9, paragraph A9.5.1.1.4, states that the NE may include voice compression and if so must support at least one of the following standards:

- ITU-T Recommendation G.726, 32 kbps Adaptive Differential Pulse Code Modulation (ADPCM)
- ITU-T Recommendation G.728, 16 kbps Low-Delay Code Excited Linear Prediction (LD-CELP)

• ITU-T Recommendation G.729, 9.6 kbps Conjugate-Structure Algebraic-Code-Excited Linear-Prediction (CS-A CELP)

The SUT supports ITU-T G.729 (8k) and ITU-T G.723.1 (5.3k and 6.3k) voice compression algorithms.

(q) Military Unique Features. The SUT supports the full complement of Military Unique Features as required in the UCR, section 3. The following types of MLPP calls were placed over all the SUT transport and access interfaces between the switching systems listed in table 2-3. All calls were completed successfully and met the MLPP interactions as required by the UCR, section 3.

1. Circuit for Reuse; Answered Call
2. Circuit for Reuse; Unanswered Call
3. Circuit not for Reuse; Answered Call
4. Circuit not for Reuse; Unanswered Call
5. Resources not Available (Intra- and inter-switch)
6. Circuit for Reuse; Answered Call (simultaneous preemption of line and trunk)
7. Circuit for Reuse; Unanswered Call (simultaneous preemption of line and trunk)

(2) Synchronization. UCR appendix 9, paragraph A9.5.1.2.7, states that the NE shall be able to derive timing signal from an internal source, an incoming digital signal, or an external source in accordance with UCR Section 11.1. The SUT can derive timing from an external T1 link. During this test, the timing for both S-NE and T-NE was derived from a dedicated T1 source, which meets the requirement.

(3) Device Management

(a) Management Option. UCR appendix 9, paragraph A9.5.2.1, states that the NE devices are to be managed by at least one of the following: The device may be managed locally by a front or back panel and/or external console control capability shall be provided for local management. NE devices in the DSN may be monitored and managed by the Advanced DSN Integrated Management Support System (ADIMSS) as described in the UCR, section 9. The SUT meets this requirement with an external console which is locally managed via Ethernet. The System Administration was conducted with a modular PC using the Windows XP Pro 2002 operating system. The System Administration functions include configuring and monitoring multiple terminals; both locally and from any remote authorized location. The SUT has a management platform called VxBuilder that provides configuration management services. The SUT can also be remotely accessed and configured by a terminal program using SSH protocol.

(b) Fault Management. UCR appendix 9, paragraph A9.5.2.2, states that the NEs may be capable of performing a self-test diagnostic function on non-active and

active channels on a noninterference basis and report any failures to the assigned network management system. The SUT has a fault management platform call VxWatch that provides alarms for active channels of the access and transport links. It does not interfere with the operation of the monitored circuit, which meets the requirement.

(c) Loop Back Capability. UCR appendix 9, paragraph A9.5.2.3, states that the NEs shall provide loop back capability on each of the trunk side interfaces in accordance with ITU-T Recommendation V.54. The SUT does not provide ITU-T V.54 loop back capability. Since this is a conditional requirement for a NE, there is no operational impact.

(4) Operational Configuration Restoral. UCR appendix 9, paragraph A9.5.3, states that the loss of power should not remove configuration settings. The unit should be restored to the last customer configured state prior to the power loss, without intervention when power is restored. The SUT was placed into a power failure condition then power was restored. The SUT returned to the last customer configured state prior to the power failure, which meets the requirement.

(5) Security. Security is tested as part of the Information Assurance testing and is covered under a separate report.

b. Summary. The SUT met all of the interface and functional requirements and is certified for joint use within the DSN as a T-NE and S-NE as set forth in appendices 2 and 9 of reference (c). The SUT offers two modes of operation: LLEM and Cluster Mode. Only the LLEM Mode was tested and covered by this certification.

12. TEST AND ANALYSIS REPORT. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at http://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi.